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SOME RESPONSES TO THE STIMULUS "PAVLOV"

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In opening the first session this morning Dr. Reese said that he felt the program showed signs of an ecumenical spirit. I don't know whether the remark was a reference to my Protestant activities, but if so, I must say it was extraordinarily generous of the College of Cardinals to have made me Pope. I shall try to learn the proper rituals. In the movie, *Zorba the Greek,* the French woman was never accepted by the islanders because she crossed herself from left to right, rather than right to left. I shall try not to make that kind of mistake. From now on it will be condition*al* reflexes.

It seems appropriate on this occasion to try to say what Pavlov has meant to me. I have to strain a bit to get back to personal reminiscences, but I can just make it. In 1929 Pavlov was enthusiastically received in Boston as President of the International Congress of Physiology. I was in my first year of graduate study in psychology at Harvard, and I turned up heroworshipping wherever Pavlov could be expected to appear. A photographer was taking orders for an official portrait. He had asked Pavlov to write his name on a sheet of paper, and he assured prospective buyers that the signature would appear on each photograph. I offered to buy one if I could have the sheet of paper when he was through with it. I got it, and still have it. It is the only autograph I have ever collected.

It was my biology teacher at Hamilton College, Albro Morrill, who first called my attention to Anrep's translation of Pavlov. I had gone back, a year after graduation, to talk with him about graduate study in psychology. He had always hoped I would be a biologist, and perhaps that was why he showed me Pavlov's book, which he had just received. In one of his courses he had already called my attention to Jacques Loeb's *The Physiology of the Brain and Comparative Psychology.* I bought Pavlov's book and took it with me to Greenwich Village, where I spent several Bohemian months before going on to Harvard. I read Pavlov by day and sowed wild oats by night. I am sure Pavlov himself would have approved of this pairing of stimuli. Even today a page of his book elicits many warm, if somewhat faded, autonomic responses.

Pavlov was particularly relevant to a rather drastic change which I had made in my plans for a career and about which I was not yet too secure. I had majored in English and had planned to be a writer. It took me a year or two to discover that although I had learned how to write, I had learned nothing worth writing about. I found I had nothing to say. I decided to go into psychology to remedy the defect. At about that time H. G. Wells wrote an article for, I believe, the Sunday *New York Times.* In it he compared Pavlov and George Bernard Shaw. They looked rather alike, with their great white beards, and it was easy for Wells to contrast the witty propagandist with the laboratory scientist. He posed a hypothetical question: If these two men were drowning, and you had only one life preserver, to which would you throw it? Wells enormously reassured me in the decision I had made by throwing it to Pavlov.

Several years later I worked for a time in the laboratory of Professor Walter B. Cannon at the Harvard Medical School. Cannon and Pavlov were close friends, and when Pavlov came to America, he stayed with the Cannons in a house on Divinity Avenue about 60 yards (I paced it off this morning) from the auditorium in which we have been meeting. Cannon told many amusing stories about Pavlov. They were gentle stories, scarcely worth telling about anyone, even of Pavlov's distinction, but here are two of them. Pavlov knew little English. He and Cannon conversed in German. One morning at breakfast Pavlov was trying to read the headlines on the sports page of a Boston paper. It appeared that a ninth inning rally of the Red Sox had fizzled. Pavlov called across the table to Cannon,

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''Was meint das Wort 'fizzle'?''—pronouncing it ''fit-zell.'' Another story had to do with the episode in which Pavlov was robbed upon his arrival in New York. He and his son were in Grand Central Terminal intending to take a train for Boston. He evidently displayed his wallet a little too conspicuously as he paid for his tickets. Two young thugs bumped against him, grabbed the wallet, containing nearly $2,000, and ran. (I believe it was the Rockefeller Foundation which came to Pavlov's rescue, making him a grant of $1,000 to permit him ''to study physiology in the United States.'') The next day Pavlov was sitting on Cannon's front porch when Cannon suggested they walk to Harvard Square for a soda. As Cannon started down the steps, Pavlov said, ''But you haven't locked your door.'' Cannon assured him it would be all right. ''But there's no one in your house, and your door is unlocked,'' insisted Pavlov. ''It doesn't matter,'' Cannon said, ''we'll be back in a little while.'' Pavlov shook his head uncertainly. ''My,'' he said, ''what a great difference between New York and Cambridge!''

Pavlov's book proved to be enormously helpful in my graduate studies. Possibly the most important lesson I learned from it, and one easily overlooked, was respect for a fact. On December 15, 1911, at exactly 1:55 in the afternoon, a dog secreted nine drops of saliva. To take that fact seriously, and to make one's readers take it seriously, was no mean achievement. It was important too that it was a fact about a single organism. Animal psychology at that time was primarily concerned with the behavior of the *average* rat. The learning curves which appeared in textbooks were generated by large groups of organisms. Pavlov was talking about the behavior of one organism at a time.

He also emphasized controlled conditions. His soundproofed laboratory, a picture of which appears in the book, impressed me greatly, and the first apparatus I built consisted of a soundproofed chamber and a silent releasebox. I suspect that the control of the environment in Pavlov's laboratory would seem rather inadequate today. I have always been suspicious of that experiment in which a dog, given food every 30 minutes without any signal, begins to salivate promptly 29 minutes after the previous delivery. I have often wondered what the experimenter did during those 30 minutes. My guess is that he left the room to attend to other matters, perhaps to have a smoke. At 29 minutes by his watch, rather than by any temporal conditioning, I imagine him tiptoeing back and noting with satisfaction that the red fluid in the glass tube shortly thereafter began to move. But whether or not the control was adequate, it was held to be of first importance.

The motto of this society is taken from Pavlov: ''Observation and observation.'' Pavlov meant, of course, the observation of nature, not of what someone had written about nature. He was opposed to dogma and would be opposed to current dogma about himself. It is now 50 years since he was most active, and that is a long time in the history of science. His position in that history is secure, for he made extraordinary contributions; but he was not free of certain limitations. His influence upon the subsequent history of the study of behavior has not always been happy. I think I can express my respect for Pavlov in a way which he would be most likely to approve if I indicate certain points on which I think he was wrong.

He turned too quickly to inferences about the nervous system. The subtitle of the Anrep translation is ''An Investigation of the Physiological Activity of the Cerebral Cortex.'' Pavlov never saw any of that activity; he was studying merely what he took to be its products. His facts were about behavior, and his effort to represent them as facts about the nervous system interfered with his reports and must have affected the design of his experiments. Pavlov probably took this line as a product of a nineteenth century materialism. Sherrington did the same thing at about the same time.

A different brand of materialism came into the story when the Soviets made Pavlov a national hero. There is no doubt that the nervous system is material; when it decays, it smells, and could one ask for better proof? Behavior on the other hand is evanescent. In talking about it without mentioning the nervous system, one runs the risk of being called an idealist. There has never been a separate Russian science of behavior. Perhaps that is one reason why cybernetics has been taken up so energetically. Mathematics and the machine analogy have at last permitted the Russians to talk about behavior without mention-

ing the nervous system. The fear of being called an idealist has led to some absurd practices. In a teacher's college in Tashkent the director told us that the college was interested in ''higher nervous activities.'' He meant simply that they were teaching teachers.

Pavlov's physiological metaphors encouraged him to speculate about processes supposed to be going on behind his facts rather than about the facts themselves. Freud had done the same thing but much more dramatically. The various kinds of inhibition which Pavlov thought he saw in his data were logically unnecessary. A response may, for many reasons, grow weak; it is not necessarily suffering extinction. But the metaphor of a central, probably cortical, process is attractive. A prestige attaches to the statement that inhibition has spread across the cortex, a prestige which is lacking in a mere recital of the facts upon which the statement is based.

Diverted from a strict formulation of behavioral facts as such, it was easy for Pavlov to believe that conditioned reflexes comprised the whole field of learned behavior, and to overlook differences even among the kinds of behavior to which the principle seems to apply. It was extraordinarily lucky that he began with the salivary reflex. There seems to be no other response quite so simple. Other glandular secretions, for example, tears or sweat, are by no means so easy to control, and we have heard today something of the enormous complexity of conditioned cardiac responses. The extension of the Pavlovian formulation to skeletal musculature raises especially difficult questions. To insist that the Pavlovian experiment is a useful prototype in formulating all learned behavior is not really very helpful.

Two or three years ago the Moscow Circus came to Boston, and the bear trainer, Mr. Filatov, expressed an interest in talking with me about animal-training procedures. My wife invited him to dinner, together with a charming interpreter and her date for the evening, the ringmaster of the circus. When we got around to shop talk, Mr. Filatov announced the ground rules: ''Now, it is all a matter of conditioned reflexes, isn't it?'' he said. I replied that in America we tried to make a distinction between the case in which the reinforcing stimulus accompanied another stimulus and the case in which it followed a response.

''That doesn't matter,'' he insisted. ''Whether the reinforcement comes before or after the response, it is still a conditioned reflex. Right?'' I saw that we could not otherwise get on to the training of bears, and so I agreed.

But of course I do not agree. A careful analysis of contingencies of reinforcement in both operant and respondent behavior seems to me an absolutely essential first step. It is not a question of differences in theory, it is a matter of reaching a formulation which fits the known facts. This is a task to which Pavlov, if he were alive today, would devote himself with his characteristic enthusiasm.

Facts and formulations of facts change as science progresses. The experimental spirit and the integrity of the scientist do not change. In the abiding aspects of the life of a scientist we still have much to learn from Ivan Petrovitch Pavlov.